

# High Order Wavelet-Based Multiresolution Technology for Airframe Noise Prediction, Phase I

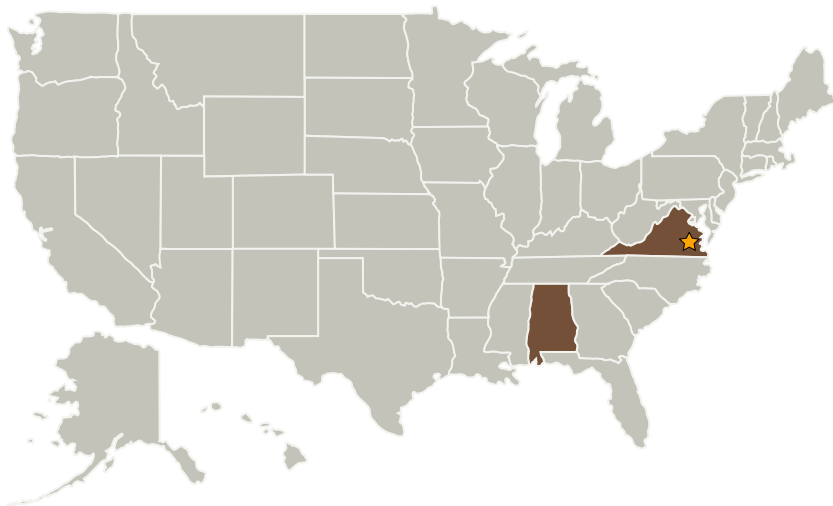
Completed Technology Project (2004 - 2004)



## Project Introduction

An integrated framework is proposed for efficient prediction of rotorcraft and airframe noise. A novel wavelet-based multiresolution technique and high-order accurate WENO scheme is proposed for efficient capturing of noise sources and unsteady flowfield. A wavelet compression is used to store the flowfield as a multi-level representation in functional space. The primary solution progresses using a coarse grid. The regularity of the flow field data is used to identify regions of steep variation. These regions are selectively solved recursively in the finer grid-levels and accurate information is injected into the coarse grids to correctly represent all flow features. In Phase I, a three-dimensional wavelet-based multiresolution algorithm, and an acoustic analogy module based on the Kirchhoff-Ffowcs Williams and Hawking methodology will be developed. The feasibility of the proposed technology will be demonstrated by prediction of three-dimensional noise source and acoustic waves of vortex-blade interaction problems. The proposed technology will provide 2-3 orders-of-magnitude reductions in CPU requirements over existing techniques. In Phase II, the wavelet compression methodology will be integrated into a high-fidelity CFD module. An efficient data structure will be developed to store and update the multiresolution data. The modules will be coupled with a nonlinear finite-element structure dynamic module for noise prediction of flexible structures.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Langley Research Center (LaRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

## Primary U.S. Work Locations

Alabama	Virginia
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## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Essam Sheta

## Technology Areas

**Primary:**

- TX15 Flight Vehicle Systems
  - └ TX15.1 Aerosciences
    - └ TX15.1.4 Aeroacoustics